

**IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF OKLAHOMA**

STATE OF OKLAHOMA, ex rel	§	
W. A. DREW EDMONDSON,	§	
in his capacity as ATTORNEY GENERAL	§	
OF THE STATE OF OKLAHOMA, and	§	
OKLAHOMA SECRETARY	§	
OF THE ENVIRONMENT	§	
C. MILES TOLBERT, in his capacity as	§	
the TRUSTEE FOR	§	
NATURAL RESOURCES FOR THE	§	
STATE OF OKLAHOMA,	§	
	§	
Plaintiff,	§	CASE NO. 05-CV-329-GFK-SAJ
V.	§	
	§	
TYSON FOODS, TYSON POULTRY, INC.,	§	
TYSON CHICKEN, INC., COBB-VANTRESS,	§	
INC., AVIAGEN, INC., CAL-MAINE FOODS,	§	
INC., CAL-MAINE FARMS, INC., CARGILL,	§	
INC., CARGILL TURKEY PRODUCTS, LLC,	§	
GEORGE'S, INC., GEORGE'S FARMS, INC.,	§	
PETERSON FARMS, INC.,	§	
SIMMONS FOODS, INC.,	§	
AND WILLOWBROOK FOODS, INC.	§	

Defendants

**DECLARATION OF REMY JEAN-CLAUDE HENNET, Ph.D.**

I, Remy J.-C. Hennet of S.S. Papadopoulos & Associates, Inc., Bethesda, Maryland, declare under penalty of perjury under the laws of the United States of America that the following is true and correct:

**Background**

1. I was retained as an expert in geochemistry, to form and render opinions on the claim filed by the State of Oklahoma ["Plaintiff"] against companies which contract with poultry growers with operations in the Illinois River Basin ["Defendants"]. I was retained by all of the Defendants. (Case NO. 05-CV-329-GFK-SAJ).

2. To conduct my assignment I was asked to review and consider the opinions and allegations of Plaintiff's experts, in particular Dr. Fisher and Dr. Olsen. The opinions and

allegations of Plaintiff's experts are in the forms of affidavits, depositions, and data and other materials.

3. My education, research, and professional experience are in the fields of geochemistry, geology, and hydrogeology. My expertise includes the evaluation of environmental data; the evaluation of the origin, fate, and transport of chemical constituents in the environment; and the evaluation of chemical fingerprints to determine the origin, extent, duration, and trend variations of environmental parameters and constituents. I have more than 20 years of research and professional experience in geochemistry. My Curriculum Vitae, list of publications, list of previous depositions and testimony, and my hourly billing rate are provided in Attachment A.

4. To conduct this evaluation I relied on my education, research, and professional experience. I considered a large amount of data, the information provided by Plaintiff's experts, and conducted my own searches of publicly available databases, reports, and the peer-reviewed literature. I had discussion with Dr. Jaffe, Dr. Andrews, Dr. Huber, and others related to the materials I reviewed. I visited the Illinois River Basin and toured a poultry production facility. I was assisted in my work by the professional staff at S.S. Papadopoulos & Associates, Inc.

#### **Summary of Conclusions and Opinions**

5. As a result of the work I conducted, I have reached the following conclusions and opinions:

- Opinion I: Plaintiff's expert Fisher's correlation between sediment phosphorus concentrations and broiler sales is flawed and unreliable.
- Opinion II: The chemical/biological fingerprinting procedure applied by Plaintiff's experts Olsen and Fisher is not diagnostic or unique to poultry litter.
- Opinion III: The plot of fecal coliforms versus time for surface water samples included in the materials provided by Plaintiff's experts Olsen and Fisher is misleading and misinterpreted by Plaintiff's experts.
- Opinion IV: Plaintiff's experts created a data set that is biased and not representative of the Illinois River Basin for the period 2005 to the present.
- Opinion V: The data and information do not support Plaintiff's allegation of an imminent and substantial endangerment of human health because of the spreading of poultry litter fertilizer in the fields.

6. I hold these conclusions and opinions with a reasonable degree of scientific certainty.

**Bases for Conclusions and Opinions****Opinion I: Plaintiff's expert Fisher's correlation between sediment phosphorus concentrations and broiler sales is flawed and unreliable.**

7. Plaintiff's expert Fisher has alleged that phosphorus concentration in Tenkiller Reservoir sediments has increased by a factor of approximately 7 (Deposition of Dr. Fisher, January 23, 2008) over the period 1954 to 2005. Plaintiff's experts attributed this alleged increase to an increase in poultry production over time. This allegation is based on the analysis of sediment Core # 1<sup>1</sup>, and on information for broiler sales from agricultural census surveys. Upon my review of the available data for the sediment cores I conclude that the methodology applied is faulty and that the allegation of a correlation between phosphorus in sediments and broiler sales over time is flawed, unreliable, and simply not supported by the data.

8. There are several errors and misleading data manipulations in the way Plaintiff's expert Fisher evaluated the sediment core data and generated his correlation. The major errors and misleading data manipulations are as follows:

- a. The oldest sample in Dr. Fisher's correlation plot (sample dated 1954 in Core #1) is not a lake sediment sample but a sample of terrestrial or soil materials that represents the top soil materials that existed prior to the construction of Tenkiller Reservoir. Soil materials contain less phosphorus than lake sediment samples and these two types of samples cannot be directly compared for their phosphorus content to evaluate a trend in a sediment core. In addition, the terrestrial sample was not dated through analysis like the other samples in the correlation but simply assigned the date 1954; the soil materials in the sample could be much older than 1954. Including the terrestrial sample that doesn't belong in the correlation imposes a strong artificial bias to the trend line. Solely by removing the terrestrial sample the phosphorus increase over the sediment profile in Core # 1 is reduced to a factor of less than 2 from the alleged factor 7; an exaggeration of approximately 400 percent.
- b. The Total Phosphorus concentration values used to graph the correlation that Plaintiff's expert Fisher relied upon are calculated values that do not represent the actual phosphorus content of the lake sediment at the time it was deposited. **First**, Total Phosphorus concentrations were measured on samples that combined lake sediment and pore water, and the water content of the samples was measured separately. The phosphorus and chemical content of the pore water was not analyzed. The Total Phosphorus concentration in the sediment itself was calculated for each sample by adjusting the results assuming that no phosphorous

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<sup>1</sup> Sediment Core # 1 was collected as one of five cores; samples from four of the five cores were submitted for age dating. The cores were collected by a diver on behalf of Plaintiff's experts.

was present in the sediment pore water<sup>2</sup>. This assumption is in error since pore water contains phosphorus. By adjusting for water content without accounting for the phosphorus in pore water, a trend in phosphorus is artificially generated simply because the water content of the shallower lake sediment is higher than for the deeper sediment because of compaction. In fact, the procedure applied by Plaintiff's expert Fisher would create a similar trend for all chemicals that are present in pore water even if the sediment itself was of uniform chemical composition across the entire cores. **Second**, there is more to the interpretation of phosphorus in sediment cores than the simple and faulty interpretation applied by Plaintiff's expert Fisher. During weathering and compaction, sediments are subjected to geochemical, biological, and physical processes that result in the redistribution of phosphorus in the sediment column and the release of phosphorus to pore water and reservoir water over time. The overall effect of these processes is a gradual depletion of phosphorus in the older deeper sediment relative to the younger shallower sediment. The concentration of phosphorus in lake sediment is not conservative, and measured phosphorus concentrations in 2005 do not represent the original composition of the sediments as they were deposited at the bottom of the reservoir starting in 1954 when the reservoir was built and started to fill up. Furthermore, shallow sediments undergo active mixing, including physical mixing and bioturbation, and the phosphorus concentration in the pore water of shallow sediments can vary greatly seasonally. These processes that control phosphorus concentration in lake sediment take place whether or not poultry litter application occurs in the fields.

Simply stated, Plaintiff's expert Fisher did not account for the artificial trend created by his methodology and ignored the geochemical, biological, and physical processes that control the distribution of phosphorus and other chemicals in lake sediments. Fisher's calculated phosphorus values are not representative of the phosphorus content of the sediments at the time these were deposited at the bottom of Tenkiller Reservoir. The data and methodology applied by Plaintiff's experts in the interpretation of the sediment cores cannot be relied upon to quantify historic trends for phosphorus in the Illinois River system.

- c. For the time axis of the correlation Plaintiff's expert Fisher relied on Pb-210 age values<sup>3</sup> generated through a combination of laboratory measurements and corrective calculations and assumptions. The results from measurements and calculations were fed to a software package to generate an output of apparent age values for the analyzed samples from core slices. Plaintiff's experts relied on these apparent age values as the time axis for phosphorus to construct the correlation with broiler sales. The apparent age values relied upon by Plaintiff's

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<sup>2</sup> Measured Total Phosphorus on the sediment slices from the four cores that were age dated actually shows a decreasing, not an increasing trend over time prior to being adjusted by Plaintiff's experts.

<sup>3</sup> Pb-210 is a radioactive isotope of lead. Pb-210 half-life or the time it takes to reduce its activity or concentration by half is approximately 22 years. The presence of Pb-210 in the earth crust and the atmosphere is related to the presence of uranium (U-238) and its daughter products, in particular radon gas (Rn-222). Pb-210 data can be used to age date certain geological materials under certain assumptions and applying appropriate corrections.

expert Fisher are in error. **First**, the apparent age values based on Pb-210 are inconsistent with the Cs-137 data<sup>4</sup> that were measured on the same sediment samples. For example, the Cs-137 data indicate that the bottom portion of the sediments in Core # 1 were deposited in the early 1960's and before, whereas the Pb-210 age values for the same samples are significantly younger (i.e. more than 10 years younger). A similar discrepancy exists for the data available for the four sediment cores for Pb-210 ages and Cs-137 data. **Second**, Tenkiller Reservoir was constructed in 1953/54 and sedimentation in the reservoir occurred as soon as a lake formed and covered the locations of the cores. Based on the average flow of the Illinois River as it enters the reservoir, the location of Core # 1 was most certainly under water a short period of time after 1953/54 (i.e. 1 year or so after completion of the 1960s is in agreement with the Cs-137 data, further indicating that the Pb-210 ages relied upon by Plaintiff's expert Fisher are in error.

Using dates that are not representative of the true age of the sediments deposited in the reservoir to correlate broiler sales to a phosphorus trend in the sediments makes the time correlation that Plaintiff's expert Fisher relies upon inaccurate and unreliable. Furthermore, an incorrect timeline on the sediments precludes the evaluation of relevant historical events<sup>5</sup> that could have resulted in variations of the phosphorus loading to Tenkiller Reservoir.

- d. Plaintiff's expert Fisher used information on broiler sales in the Illinois River Basin to correlate with phosphorus and support the allegation that the application of poultry litter as fertilizer to fields is responsible for the phosphorus trend that they generated. Broiler sales have increased over time but an increase in sales tells little on the handling and spreading of fertilizer in the fields. The introduction of best management practices for the spreading of poultry litter fertilizer have been implemented in the Illinois River Basin and these practices are designed to effectively reduce the potential for the release of poultry litter bacteria and nutrients to surface water and groundwater. Furthermore, the composition of poultry feed, and therefore the composition of poultry litter, varies between producers and over time. Broiler sales are therefore not a parameter that accurately or reliably represents the release of bacteria and nutrients to surface water from poultry litter field applications over time. There are sources of bacteria and nutrients other than poultry litter that have increased over time in the

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<sup>4</sup> Cesium-137 is a radioactive isotope of cesium; it is formed through nuclear fission in nuclear reactors and/or during the detonation of nuclear weapons. Cs-137 half-life or the time it takes to reduce its activity or concentration by half is approximately 30 years. The deposition of sediments with elevated Cs-137 took place in the 1950s and early 1960s during the period of atmospheric thermonuclear testing. A large and sudden increase of Cs-137 is a time marker in the sediment column. The time marker is coincident on one end with the beginning of nuclear testing in the atmosphere around 1950 and on the other end with the ban and reduction of such testing in 1963.

<sup>5</sup> For example: the Frances Lake Dam breach in 1990 on the Oklahoma-Arkansas border upstream of Lake Tenkiller; changes in the operation of water treatment plants; industrial developments; deforestation; periods of increased urbanization; and the introduction of best management practices for poultry litter application to fields.



Illinois River Basin. These include effluents from population growth and urbanization, industrial development, and animal farming other than poultry.

9. As a summary for Opinion I, the Phosphorus in Sediment to Broiler Sales correlation relied upon by Plaintiff's expert Fisher is flawed and unreliable and provides no credible scientific support to Plaintiff's allegation that the application of poultry litter fertilizer represents an imminent and substantial endangerment of human health in the Illinois River Basin.

**Opinion II: The chemical/biological fingerprinting procedure applied by Plaintiff's experts Olsen and Fisher is not diagnostic or unique to poultry litter.**

10. Plaintiff's experts relied on what they describe as identifiable constituents of environmental concern in poultry litter, including phosphorus, metals and bacteria. Plaintiff's experts used the chemical and bacteria data to create what they claim to be a "unique and distinctive chemical/bacterial signature" for poultry litter. The composition of the "unique and distinctive signature" was not described specifically in any of the Plaintiff's experts' affidavits or supporting materials. However, in his deposition, Dr. Fisher described the components of the unique signature as: phosphorus, copper, zinc, arsenic, and bacteria (Dr. Fisher Deposition, January 23, 2008). In his deposition, Dr. Olsen mentioned that he relied on 25 parameters including bacteria to characterize a unique and distinctive signature for poultry litter. Plaintiff's expert Olsen arrived at his 25 parameters by apparently applying a trial and error methodology. Early sets of data that were tested by Dr. Olsen included up to 41 parameters and others less than 25. Based on this approach and relying at least partially on statistics, Plaintiff's expert Olsen concluded that the poultry litter "signature" can be found in the various pathway components that he considered.

11. The assumption or conclusion by Plaintiff's experts Olsen and Fisher that the signature that they relied upon to trace poultry litter is unique and distinctive is in error and not supported by the data or the peer-reviewed literature. Plaintiff's experts' procedure and reliance on a chemical and bacteria signature suffers from the following major shortcomings:

- a. Bacteria are ubiquitous in the natural environment and are present in all animal and human wastes; bacteria are not unique to poultry litter. The effluent of sewage treatment plants and lagoons, septic system effluent, waste streams from cattle, swine, wildlife, landfills, and other urban waste streams all contribute bacteria to the environment, and a portion of these contributions are directly to surface water. On the other hand poultry litter fertilizer is applied to fields under best management practices designed to eliminate or reduced runoff to streams and rivers.
- b. Phosphorus, copper, zinc, and arsenic and the other chemicals considered by Plaintiff's experts are ubiquitous in the natural environment and are present at

elevated concentrations in waste streams other than from poultry litter. These other waste streams include domestic and wild animal waste, septic and water treatment effluents, urban storm water, landfill leachate, and industrial effluents. Phosphorous, copper, zinc, arsenic and bacteria are naturally present in soil and rock materials that are being eroded to surface water and deposited as sediments in Tenkiller Reservoir. These chemicals are therefore not unique to poultry litter. Based on my review of the available data and the peer-reviewed literature, the fingerprints (i.e. relative concentrations of the chemicals) formed by the combination of these four chemicals in poultry litter are not differentiable for waste streams that include cattle, swine and septic wastes, and waste water treatment plant and lagoon effluents, for example.

- c. Plaintiff's experts Olsen and Fisher supervised, contributed, and/or participated to the design of the various field sampling efforts that were used to support their allegations. The major goal of the sampling approach appears to have been the targeting of locations and sample media with the highest likelihood to encounter poultry litter. This approach results in a biased data set. The bias in the data set was not considered by Plaintiff's experts Olsen and Fisher.
- d. Plaintiff's experts Olsen and Fisher did not take into account the reactivity and the variable fate and transport behaviors of the constituents they considered to construct a signature for poultry litter. Their "unique and distinctive signature" for poultry litter is not conservative in space and time in the environment and therefore does not constitute a reliable fingerprint for poultry litter. For example, phosphorus, arsenic, copper, zinc and many of the other parameters relied upon by Plaintiff's experts are reactive chemicals with specific properties. Geochemical conditions vary widely between the different pathway components that were identified by Plaintiff's experts. Exposure to the variable environment changes the concentration ratios or "signature" of these components along the transport pathway(s). Bacteria are affected by die-off, sorption, and filtration processes. Because of the compound specific properties and reactivity of the chemical constituents and the limited and variable lifespan of bacteria, the "unique and distinctive signature" is not conserved in the environment and cannot be used as a diagnostic tool for poultry litter as claimed by Plaintiff's experts.
- e. The statistical testing, in particular Dr. Olsen's use of the Principal Component Analysis tool to support his "unique and distinctive signature" approach is flawed and impaired by errors. A more extensive discussion of the errors or flaws in Dr. Olsen's approach and methodology are addressed by Dr. Huber in his Declaration. Dr. Huber is a statistician with whom I discussed Dr. Olsen's procedure and methodology. Based on my own education and experience with statistics, I noticed several flaws that render any conclusions from these tests unreliable or invalid including:
  - i. Dr. Olsen failed to include and statistically evaluate all potential sources that can contribute to the parameters he considered in his testing.

- ii. Dr. Olsen assumed that the parameters he considered are conservative in space and time in the environment. This assumption is in error since many of the parameters used in the statistical testing are differentially reactive and/or degrade or die-off in the environment.
- iii. Dr. Olsen did not consider uncertainty as part of his statistical evaluation. Parameter measurements can yield widely different error bars (for example, the error bar on bacteria counts are much larger than error bars on zinc measurements).

12. As a summary for Opinion II, the “unique and distinctive chemical/bacterial signature” for poultry litter that is relied upon by Plaintiff’s experts is neither unique nor distinctive but common to several active waste streams in the Illinois River Basin. The signature contains constituents that are reactive to different degrees and is therefore not conservative over space and time. Furthermore, Plaintiff’s experts failed to consider the natural background concentrations for the signature constituents, and the presence of these constituents in active waste streams other than poultry in the Illinois River Basin. In short, the “signature” procedure as applied by Plaintiff’s experts is unreliable and cannot be used to differentiate poultry litter from other contributors of chemicals and bacteria to surface water and groundwater.

**Opinion III: The plot of fecal coliforms versus time for surface water samples included in the materials provided by Plaintiff’s experts Olsen and Fisher is misleading and misinterpreted by Plaintiff’s experts.**

13. Plaintiff’s experts plotted the average fecal coliforms in surface water samples in the Illinois River Basin for the period 1993 to 2006. Plaintiff’s experts attached a best fit curve to the plot. The plot and the curve are apparently used to support the allegation that fecal coliforms have been increasing over time in surface water and that this increase represents an imminent and substantial endangerment of human health.

14. The plot and best fit curve are misleading and confusing because the data include results for fecal coliforms that are not directly comparable. The following explains the lack of scientific rigor and abusive use of correlation statistics by Plaintiff’s experts in their interpretation of the plot for fecal coliforms:

- a. The data used for the plot fails to differentiate between the results for fecal coliforms for high flow samples and the results for normal or base flow samples. Samples taken under high flow conditions typically contain much higher bacterial counts, including fecal coliforms, than samples taken under normal or baseline flow conditions. This difference is simply related to the fact that runoff washes off the exposed surface of the soil, and the surface of the soil typically contains more bacteria than the subsurface. Under high flow conditions, there is more suspended solids in the surface water samples, and bacteria preferentially attach to solid particulates therefore increasing the counts in the samples. The observation



of higher bacteria levels under high flow conditions is a general observation that is not unique to the Illinois River Basin. High flow samples were more frequently collected starting around 2000 to study the bacterial and chemical composition of surface water at peak flow conditions; there is relatively less such high flow data represented prior to that time. In order to evaluate the existence of a trend in fecal coliforms over time, it is neither proper nor scientific to ignore the bias introduced in the data set by the high flow sample results.

- b. The best fit curve applied by Plaintiff's experts to the fecal coliforms versus time plot is not a proper interpretation of the data. **First**, the data set shows that there was no significant trend for fecal coliforms in surface water prior to approximately 2000. The large jump in fecal coliforms that starts in the approximately 2000 represents the effect of the high flow samples becoming relatively more frequent in the most recent sampling events. This bias is evident upon comparison of flow and bacterial count measurements at individual stations along the Illinois River<sup>6</sup>. **Second**, the best fit curve by Plaintiff's experts does not represent the data. The data shows that prior to approximately 2000, there is no trend in bacterial counts. A jump occurred in approximately 2000 reflecting the more frequent representation of high flow samples in the data set. The best fit curve is not justified to represent the distribution of the data. This is further supported by the weak correlation between the curve and the data expressed as " $r = 0.57$ " on the plot<sup>7</sup>. **Third**, even if one were to assume that the fecal coliforms in surface water have increased as depicted by the best fit curve on the plot, a conclusion that I disagree with, changes in broiler sales do not explain the fecal coliforms distribution in the plot. The broiler sale distribution used by Plaintiff's expert Fisher is different from the bacteria data distribution.

15. As a summary for Opinion III, Plaintiff's experts have constructed a plot and a correlation that improperly include data that are not comparable for the evaluation of a trend in fecal coliforms in surface water over time. The correlation derived from this improper use of data is weak at best. The plot and correlation do not establish a relationship between poultry litter and changes in fecal coliforms concentrations in surface water.

**Opinion IV: Plaintiff's experts created a data set that is biased and not representative of the Illinois River Basin for the period 2005 to the present.**

16. Consultants were hired by Plaintiff to collect samples for the analysis of chemicals, bacteria, and other parameters. The results are used to support the allegations made by Plaintiff's experts. Many of the sampling locations and the conditions under which samples were collected were targeted based on consultants' and/or Plaintiff's

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<sup>6</sup> See for example the data collected at the Tahlequah station located directly upstream of the Tenkiller Reservoir.

<sup>7</sup> Correlation coefficients are usually represented by the square of  $r$  not  $r$ . The square of  $r$  is equal to 0.32 which is very low for a best fit correlation.

experts' judgment of highest likelihood to encounter poultry litter. Furthermore, high flow and runoff samples are over represented relative to the samples that represent normal or average conditions in the Illinois River Basin. Many groundwater samples were taken with a Geoprobe directly at the water table beneath fields where poultry litter amendments and cattle grazing occurred. The groundwater sampled at the water table at these particular locations is not representative of the groundwater that is supplied through residential wells. The data set relied upon by Plaintiff's experts is therefore biased because it is overloaded with samples that do not represent normal or average conditions and that do not represent the water to which humans are typically exposed. In the interpretation of the data, Plaintiff's experts did not account for the bias in the data set.

17. Comparing samples that were collected periodically across the State of Oklahoma at several stream monitoring stations and excluding the samples that explicitly targeted high flow conditions shows that the Illinois River Basin is not out of range for bacterial counts relative to the other basins in Oklahoma.

18. Plaintiff's experts have created an artificial increasing trend for bacteria and nutrients in the Illinois River system by including the targeted sample results that exist only for the most recent years, without appropriate consideration of the bias introduced by this procedure.

19. The samples that were collected by Plaintiff's consultants on behalf of Plaintiff's experts under high flow, runoff conditions, and/or at targeted locations produced uncertain results for bacterial counts. The uncertainty introduced in that particular data set resulted mostly because of the following:

- a. Sampling for bacteria analysis is strongly dependent on procedure and on the experience of the sampling personnel. The samples collected on behalf of Plaintiff's expert were collected by many different people and analyzed by different laboratories.
- b. Bacterial counts in water samples are strongly correlated to the amount of suspended solids in the sample. Different sampling procedures result in different suspended solids contents and different bacterial counts.
- c. Plaintiff's consultants were observed to have been less than careful in following proper procedures when sampling in the field. Improper procedures in the collection of samples for bacterial analysis compromise the integrity of the samples and typically results in inflated bacterial counts upon analysis.

20. As a summary for Opinion IV, Plaintiff's experts have created a data set that is biased and they failed to account for this bias in the manner they interpreted the data and supported their allegations.

**Opinion V: The data and information do not support Plaintiff's allegation of an imminent and substantial endangerment of human health because of the spreading of poultry litter fertilizer in the fields.**

21. Plaintiff alleges that there is an imminent and substantial endangerment of human health because of the presence of bacteria in surface water and groundwater in the Illinois River Basin and that the application of poultry litter fertilizer on the fields is responsible for this threat. Plaintiff's experts have opined that the available data support this allegation.

22. The data does not support the allegation of imminent and substantial endangerment of human health, and the data does not support a recent significant increase in bacteria in surface water and groundwater. Furthermore, the available data and information do not support the allegation that the spreading of poultry litter fertilizer on the fields has somehow changed for the worst as to become an imminent threat to surface water and groundwater.

23. As a summary for Opinion V, the allegation of imminent and substantial endangerment of human health is simply not supported by the data.

A handwritten signature in cursive script, appearing to read 'R. Hennet', written in black ink.

Remy Jean-Claude Hennet, Ph.D.

A handwritten date 'February 8, 2008' in cursive script, written in black ink.

Date

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## **Attachment A**

### **Dr. Hennet's Curriculum Vitae and Rate of Compensation**

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**REMY J.-C. HENNET**

Geochemist

<b>EDUCATION</b>	<b>PhD</b> Geochemistry, 1987, Princeton University, Princeton, New Jersey <b>MA</b> Geology, 1983, Princeton University, Princeton, New Jersey <b>Diplome</b> de 3eme Cycle, Hydrogeologie, 1981, Universite de Neuchatel, Switzerland <b>Diplome</b> de Geologie, Sciences Exactes, 1980, Universite de Neuchatel, Switzerland
<b>REGISTRATIONS</b>	<b>Certified Professional Geological Scientist</b> No. 10572, American Institute of Professional Geologists <b>Licensed Professional Geoscientist</b> Texas No. 425
<b>LANGUAGES</b>	French, German
<b>PROFESSIONAL HISTORY</b>	<b>S.S. Papadopoulos &amp; Associates, Inc.</b> , Bethesda, Maryland Principal of the Firm, 1989-present <b>Woods Hole Oceanographic Institution</b> , Woods Hole, Massachusetts Postdoctoral Investigator, 1987-1989 <b>Princeton University</b> , Princeton, New Jersey Research Assistant, 1983-1987 Teaching Assistant, 1982-1985 <b>Universite de Neuchatel</b> , Centre d'Hydrologie, Switzerland Research Assistant, 1980-1981
<b>SUMMARY OF QUALIFICATIONS</b>	Dr. Hennet has over 20 years of research and field experience in investigating the origin, fate, and transport of organic and inorganic chemicals in natural and man-made environments. He has conducted numerous studies that cover the fields of environmental characterization, remediation, monitoring, cost allocation, and litigation. Dr. Hennet's expertise includes the forensic interpretation of chemical fingerprints, in particular for PCB congeners, petroleum hydrocarbons, organic solvents, toxic metals, and inorganic ions such as arsenic and selenium chemical species, nitrate, and perchlorate. His expertise also includes the interpretation of stable isotope data as to quantify or qualify environmental processes. Dr. Hennet has authored and co-authored numerous publications on both inorganic and organic geochemistry.
<b>APPOINTMENTS</b>	<b>Geological Sciences Advisory Board</b> , University of Alabama, 2002-2005 <b>Member of Governing Board</b> , Association of Princeton Graduate Alumni, 1996-2001 <b>Convenor</b> , THEIS 2000 Conference: <i>Iron in Groundwater</i> , National Ground Water Association, September 2000 <b>Technical Advisory Board</b> , Xetex Corporation, 1993-1999 <b>Member of Steering Committee</b> , Working Group 91, Scientific Commission for Oceanic Research, 1989-1992
<b>AWARDS &amp; HONORS</b>	<b>Postdoctoral Scholar</b> , Woods Hole Oceanographic Institution, 1987-1989 <b>Princeton University Fellowship</b> , 1982-1987 <b>Swiss National Science Foundation Fellowship at Princeton University</b> , 1981-82 <b>Mention Bien</b> , Geologie, Universite de Neuchatel, 1980





## REMY J.-C. HENNET

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Geochemist

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### REPRESENTATIVE PROJECT EXPERIENCE

#### **S.S. Papadopoulos & Associates, Inc., Bethesda, Maryland**

Projects that exemplify Dr. Hennet's experience are presented below:

- U.S. Department of Justice – Served as an expert witness for several environmental litigation cases. Examples: the quantification of the history of benzene flux from the subsurface to ambient air following the release of military jet fuel; the evaluation of multi-source petroleum hydrocarbon releases and their individual extent; the evaluation of the impact of bleaching agent when released in a desert environment; and the origin, fate, transport, and timing of the release of chlorinated solvents at several military bases.
- Citizens About Rushton Rezoning, Inc., South Lyon, Michigan – Analyzed the potential environmental and hydrogeological impacts of water treatment lagoons and infiltration spraying fields. The lagoons and spraying fields were selected as a wastewater treatment for a large residential development. The spraying fields were located on sloped glacial till with limited permeability and capacity. Regulated surface water bodies were located adjacent to the spraying fields and lagoons.
- Atlantic Richfield Company – Provided technical support for natural resource damage litigation; retained and testified as an expert witness. Work included the evaluation of complex data and information, data acquisition and interpretation, and geochemical modeling. Examples of work:
  - Collected data within the Anaconda Tailings Ponds to support the simulation by modeling of the fate and transport of dissolved arsenic and cadmium in the alluvium beneath and down-gradient of the ponds;
  - Evaluated the background condition for metals, arsenic, and sulfur chemical species in the Butte mining district; and
  - Evaluated the mobility of arsenic in the groundwater environment at the Montana Pole wood treatment site; evaluated background conditions and the mobility of metals and arsenic chemical species in sediments accumulated behind the Milltown Reservoir on the Clark Fork River.
- Rhone Poulenc Corporation – Studied arsenic fixation in soil material by various physicochemical treatments. This study was a collaborative effort with Pennsylvania State University and was aimed at understanding the processes that control the fixation of arsenic in soils. Advised on the interpretation of data to characterize the mobility of arsenic chemical species at the Bay Road Site in the San Francisco Bay area, and at the Factory Lane Site in New Jersey.
- Millenium Inc. – Served as an expert witness to evaluate environmental conditions and allocate remedial costs among several parties that occupied an industrial site for different periods of time. The site was contaminated by a variety of solvent and hydrocarbon compounds.
- Panhandle Eastern Pipeline Company – Evaluated and characterized the fate, transport, and distribution of PCBs in the subsurface at several sites along a major pipeline system. The study included basic research to interpret the distribution of the 209 different PCB molecules in water, soil, and oil samples. The results provided valuable insight for the design of remedial actions and



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Geochemist

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**REPRESENTATIVE  
PROJECT  
EXPERIENCE**  
— *continued*

- characterization of biological, physical and chemical processes affecting PCBs in the subsurface.
- EnviroSAFE Services Landfill, Toledo, Ohio – Reviewed detailed organic, inorganic, and isotopic data to evaluate the integrity of a large active landfill complex located in an area characterized by historical waste disposal activity.
- Lone Pine Superfund Site, Freehold, New Jersey – Performed data collection and interpretation to predict chemical composition for the design of a treatment facility.
- Heleva Superfund Site, Allentown, Pennsylvania – Conducted specialized sampling for the determination of trace amount chlorinated hydrocarbons in acetone-rich groundwater, and acquisition of isotope and nutrient data to characterize subsurface conditions for natural attenuation and treatment plant design.
- Love Canal (Niagara Falls, New York) and Stringfellow (Glen Avon, California) Superfund Sites – Performed detailed data interpretations to assess the validity of expert witness' testimonies related to the fate, behavior, and migration of toxic chemicals in the subsurface.
- Tyson Superfund Site, Pennsylvania – Conducted a detailed technical investigation of the performance of a large vacuum extraction system consisting of more than 250 individual extraction wells. The extraction of volatile organic compounds was impacted by subsurface heterogeneities and the presence of residual non-aqueous phase liquids in the subsurface.

**Woods Hole Oceanographic Institution, Woods Hole, Massachusetts**

Studied the organic and inorganic chemistry of the Guaymas Basin hydrothermal system. The research included the use of the research submarine Alvin for in-situ parameter measurements and sampling. Researched and studied the formation of natural petroleum, and the effects of organic molecules' degradation and migration on the formation of geopressured zones.

**Princeton University, Princeton, New Jersey**

As Research Assistant, studied metal-organic interaction in natural settings, and served as Senior Thesis Advisor on an experimental study of lead-organic complexing, and an experimental study of trichloroethane in groundwater. Served as Teaching Assistant in Historical Geology and Geomorphology.

**Universite de Neuchatel, Centre d'Hydrologie, Switzerland**

Studied tritium in groundwater and conducted related laboratory work. Conducted geochemical fingerprinting in carbonate terrains as applied to the development of water resources.

**PROFESSIONAL  
SOCIETIES**

American Academy of Forensic Sciences  
American Chemical Society  
American Institute of Professional Geologists  
Association of Ground Water Scientists and Engineers  
Geological Society of America

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**DEPOSITION AND  
TESTIMONY  
EXPERIENCE****DEPOSITIONS**

- 2007 Arbitration in the Issue of PCB Contamination in the Little Mississinewa River, Union City, Indiana. Pittsburgh, Pennsylvania. August 22.
- 2007 San Diego Unified Port District vs. TDY Industries, Inc.; Ryan Aeronautical Company; Teledyne Ryan Company; Teledyne Ryan Aeronautical Company; Teledyne Industries, Inc; Allegheny Teledyne, Inc.; Allegheny Technologies, Inc. United States District Court, Southern District of California. Case Number 03 CV 1146-B (POR). January 5.
- 2006 Sierra Club, Natural Resources Defense Council, and Natural Parks Conservation Association vs. Robert B. Flowers, Chief of Engineers, United States Army Corps of Engineers, et al. U.S. District Court, Southern District of Florida. Case No. 03-23427-CIV-Hoeveler. October 31 and November 17.





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**DEPOSITION AND  
TESTIMONY  
EXPERIENCE**

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**TESTIMONY**

- 2006 Sierra Club, Natural Resources Defense Council, and Natural Parks Conservation Association vs. Robert B. Flowers, Chief of Engineers, United States Army Corps of Engineers, et al. U.S. District Court, Southern District of Florida. Case No. 03-23427-CIV-Hoeveler. November 28 and 29.
- 2004 - 2005 Universal Waste, Inc. and Clearview Acres, Ltd. Regarding Delisting Petition for Site Number 0633009. Adjudicatory Hearing by New York Department of Environmental Conservation, Office of Hearings and Mediation. Site Number 0633009. October 27 and February 3.
- 2004 Part 31, City of South Lyon and the Citizens About Rushton Rezoning, Inc., Permit No.: M 00994; and Permit No: GW186300602. State of Michigan, Department of Environmental Quality, Office of Administrative Hearings, Lansing, MI. May 20, 21, and 27.



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### **Rate of Compensation**

Dr. Hennet's rate of compensation is \$232.00 per hour.